

WHAT IS CLAIMED IS:

1. A method of reproducing original audio data in response to a value of a playback speed designated by a user, comprising the steps of:

5 performing a time scale modulation processing with respect to the original audio data in accordance with a time scale modulation algorithm to increase or decrease quantity of the original audio data in response to the value of the playback speed; and

10 down-sampling or up-sampling with respect to audio data obtained by the time scale modulation processing in accordance with the value of the designated playback speed to restore quantity of sampled audio data to a level of the same as the original audio data,

15 whereby a tone of the sampled data is substantially identical with that of the original audio data while the sampled data is reproduced at the playback speed designated by the user.

20 2. A method of reproducing audio data as claimed in claim 1, further comprising a step of newly calculating a presentation time interval of the audio data to be increased/decreased in accordance with the value of the designated playback speed whenever the change of the playback speed is instructed.

3. A method of reproducing audio data as claimed in claim 2, further comprising a step of reproducing the sampled audio data by a newly-calculated presentation time interval.

25 4. A method of reproducing audio data as claimed in claim 1, wherein the step

of time scale modulation comprises the steps of:

writing the original audio data stored in buffer means on an input queue in a set unit per predetermined time interval; and

performing the time scale modulation algorithm in the frame unit upon the audio data stored in the input queue to decrease the quantity of the audio data in accordance with the designated playback speed when the designated playback speed is faster than the normal playback speed, or to increase the quantity of the audio data in accordance with the designated playback speed when the designated playback speed is slower than the normal playback speed, thereby providing the audio data to a middle queue.

5. A method of reproducing audio data as claimed in claim 4, wherein the sampling step comprises the steps of:

with respect to the audio data stored in the middle queue, performing the up-sampling processing when the designated playback speed is faster than the normal playback speed, performing the down-sampling when the playback speed is slower than the normal playback speed, wherein quantity of the sampled audio data to be transferred to an output queue becomes substantially identical with the quantity of the original audio data; and

transferring the sampled audio data stored in the output queue to the buffer means in the set unit per predetermined time interval.

6. A method of reproducing audio data as claimed in claim 5, wherein each of the input queue, middle queue and output queue is operated as a circular queue by controlling a queue pointer thereof.

7. A method of reproducing audio data as claimed in claim 5, wherein the sampled audio data of the output queue is overwritten to the buffer means so as to replace the original audio data existing in the buffer means.

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8. A method of reproducing audio data as claimed in claim 4, wherein the predetermined time interval is a newly calculated presentation time interval of the sampled audio data which is varied in accordance with the value of the designated playback speed.

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9. A method of reproducing audio data as claimed in claim 4, wherein the number of sets of the original audio signal which is written to the input queue is cumulatively counted, and a calc-nextframe flag having a default value as Disable is shifted to be Enable when the counted number of sets becomes equal to the number of sets of one frame, thereby performing the time scale modulation algorithm in the frame unit.

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10. A method of reproducing audio data as claimed in claim 4, wherein the set unit is comprised of one audio data in case of a mono system or of two audio data for left/right channels in case of a stereo system.

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11. A method of reproducing audio data as claimed in claim 1, wherein in the up/-down sampling, a varying ratio of data quantity is calculated in accordance with the value of the designated playback speed, and the quantity of the audio data obtained by the time scale modulation processing is varied in accordance with the

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varying ratio while characteristics of the audio data before and after the up/down-sampling are substantially identically maintained by using an interpolation method.

12. A method of reproducing audio data as claimed in claim 1, wherein the
5 time scale modulation algorithm increases or decreases the quantity of the original audio data in accordance with the value of the designated playback speed while maintaining the characteristics of the original audio data.

13. A method of reproducing decoded audio data in response to a playback
10 speed designated by a user before supplying the decoded audio data stored in storage means having been decoded in the MPEG system to audio output means, comprising the steps of:

calculating a playback speed control ratio between the designated playback
speed and a normal playback speed, and multiplying a presentation time interval of
15 the decoded audio data in case of the normal playback speed by the playback speed control ratio to produce a new presentation time interval of the audio data;

writing the decoded audio data stored in the storage means on an input queue in
a set unit;

performing a time scale modulation algorithm in the frame unit with respect to
20 audio data written on the input queue to increase or decrease a quantity of the decoded audio data in proportion to the playback speed control ratio, where audio data after the time scale modulation processing is written on a middle queue;

with respect to the audio data written in the middle queue, performing an up-
sampling in case of a fast playback mode having the playback speed control ratio
25 smaller than 1 or a down-sampling in case of a slow playback mode having the

playback control ratio larger than 1, in a manner that a sampling rate is applied to be a reverse number of the playback speed control ratio for allowing the quantity of the audio data after performing the sampling to be substantially identical with the decoded audio data and sampled audio data is transferred to an output queue;

5 writing the audio data stored in the output queue to the storage means in the set unit to replace existing decoded audio data; and

reproducing the audio data newly written to the storage means by the produced presentation time interval,

10 whereby a tone of a reproduced sound is substantially identical with that of the normal playback speed even when the designated playback speed is faster or slower than the normal playback speed.

14. A method of reproducing audio data as claimed in claim 12, wherein each of the input queue, middle queue and output queue is operated as a circular queue by
15 controlling a queue pointer thereof.

15. A method of reproducing audio data as claimed in claim 12, wherein
20 wherein the set unit is comprised of one audio data in case of a mono system or of two audio data for left/right channels in case of a stereo system.

16. A method of reproducing audio data as claimed in claim 12, wherein in the up/down sampling, the amplitudes of the respective audio data are determined by implementing an interpolation method with respect to amplitudes of the audio data
25 stored in the middle queue in accordance with the value of the playback speed

control ratio to substantially identically maintain audio characteristics before and after the sampling

17. A method of reproducing audio data as claimed in claim 12, wherein the time scale modulation algorithm increases or decreases the quantity of the decoded audio data in accordance with a value of the designated playback speed while maintaining the characteristics of the decoded audio data.

18. A method of reproducing audio data after being subjected to a filtering processing in accordance with a value of a playback speed designated by a user, comprising the steps of:

increasing or decreasing a presentation time of the audio data of a normal playback speed in response to the value of the designated playback speed, and maintaining a presentation time interval of the audio data to have a value of the normal playback speed;

performing a time scale modulation processing by using a predetermined time scale modulation algorithm with respect to the audio data to increase or decrease a quantity of the audio data in accordance with the value of the designated playback speed; and

reproducing the audio data obtained from the time scale modulation processing during the changed presentation time by the presentation time interval,

whereby a tone of a reproduced sound is substantially identical with that of the normal playback speed even when the designated playback speed is faster or slower than the normal playback speed.

19. A method of reproducing audio data as claimed in claim 18, wherein the predetermined time scale modulation algorithm increases or decreases the quantity of the decoded audio data in accordance with the value of the designated playback speed while maintaining the characteristics of the decoded audio data.

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20. An apparatus for reproducing audio data in response to a value of a playback speed designated by a user, comprising:

playback speed control means for producing a playback speed control ratio between the designated playback speed and a normal playback speed, and a new presentation time interval by multiplying a presentation time interval of the audio data at the normal playback speed by the playback speed control ratio;

storage means for storing by defining the audio data in a packet unit;

filtering means for performing a time scale modulation processing in accordance with a predetermined time scale modulation algorithm with respect to the audio data stored in the storage means to increase or decrease a data quantity of the audio data in accordance with the value of the designated playback speed, performing a down-sampling or up-sampling with respect to audio data obtained from the time scale modulation processing in accordance with the value of the designated playback speed to restore the quantity of sampled audio data to a level substantially identical with that of the audio data prior to the time scale modulation processing, and writing the sampled audio data on the storage means to replace the existing audio data; and

audio output means for receiving the filtered audio data from the storage means by a new presentation time interval and reproducing the filtered audio data into a sound,

whereby a tone of a reproduced sound is substantially identical with that of the normal playback speed even when the designated playback speed is faster or slower than the normal playback speed regardless of being reproduced by the new presentation time interval.

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21. An apparatus of reproducing audio signals as claimed in claim 20, wherein the predetermined time scale modulation algorithm increases or decreases the quantity of the audio data in accordance with the value of the designated playback speed while maintaining the characteristics of the audio data.

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22. An apparatus of reproducing audio signals as claimed in claim 20, wherein in the up/-down sampling, the filtering means calculates a varying ratio of data quantity in accordance with the value of the designated playback speed, and varies the quantity of the audio data obtained by the time scale modulation processing in accordance with the varying ratio while substantially identically maintaining characteristics of the audio data before and after the up/down-sampling by using an interpolation method.

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23. An apparatus of reproducing audio signals comprising:

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audio signal supplying means for reading out to provide audio signals from a recording medium in response to a value of a playback speed designated by a user; and

digital signal processing means having a background portion for simultaneously performing a writing of audio data of the audio signal supplying means on an input queue in the set unit and a reading out of the audio data stored in an output queue in

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the set unit as the same one period, and converting the audio data read out from the output queue into an analog signal, and a foreground portion for performing a predetermined time scale modulation by using a predetermined time scale modulation algorithm in the frame unit with respect to the audio data stored in the input queue to increase or decrease the data quantity in response to the value of the designated playback, performing a down-sampling or up-sampling with respect to the audio data obtained by the time scale modulation processing in accordance with the value of the designated playback speed to restore a quantity of the sampled audio data to a level substantially identical with that of the audio data prior to the time scale modulation, and transferring the sampled audio data to the output queue.

24. An apparatus of reproducing audio signals as claimed in claim 23, wherein the digital signal processing means further comprises analog/digital converting means for converting an analog audio signal into digital data between the audio signal supplying means and input queue when the audio signal supplied from the audio signal processing means is an analog signal.

25. An apparatus of reproducing audio signals as claimed in claim 23, wherein the predetermined time scale modulation algorithm increases or decreases the quantity of the audio data in accordance with the value of the designated playback speed while maintaining the characteristics of the audio data.

26. An apparatus of reproducing audio signals as claimed in claim 23, wherein in the up/-down sampling, the digital signal processing means calculates a varying ratio of data quantity in accordance with the value of the designated playback speed,

and varies the quantity of the audio data obtained by the time scale modulation processing in accordance with the varying ratio while substantially identically maintaining characteristics of the audio data before and after the up/down-sampling by using an interpolation method.

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